and a lower driving end drivingly connected to the [pumping member to drive] shielding means, [the pumping member] to rotate the pumping member in said path of motion when the power device is actuated;

the shaft having a first coefficient of thermal expansion and the shielding means having a different coefficient of thermal expansion; [and]

the shaft being telescopically disposed in the shielding means out of contact with the molten metal, and forming a chamber between the shaft and the shielding means sufficient to permit thermal expansion of the shaft without imposing a radial thermal stress on the shielding means; and

means connecting the shielding means to the shaft such that the shielding means and all internal components disposed therein rotate as a unit with the shaft.

In claim 7, line 3, change "pump housing" to --- pumping member ---.

In claim 10, lines 2-3, change "pump housing" to --- pumping member --- and in line 10, insert ---a-- before "structure".

In claim 11, lines 3-4, change "pump housing" to --- pumping member ---.

In claim 12, line 1, change "11" to --- 69 ---.

In claim 13, line 1, change "11" to --- 69 ---.

In claim 14, line 1, change "11" to --- 69 ---.

~~16~~. (Twice Amended) A combination, comprising:

pot means for containing a bath of molten metal;

a pumping member adapted to be disposed in a bath of a heated molten metal, and to move a stream of molten metal as the pumping member is driven in a path of motion;

a housing at least partially enclosing the pumping member;

a shielding means carried on the pump housing, the shielding means having an internal shaft-receiving opening;

a power device adapted to be supported above the bath of molten metal, and to be actuated in a powered motion;

means for connecting the power device to the pumping member to move the pumping member in said path of motion, comprising;

a pumping shaft having an upper end connected to the power device so as to be moved when the power device is actuated, and a lower driving end connected to the pumping member to drive the pumping member in said path of motion when the power device is actuated;

the driving end of the shaft having a first coefficient of thermal expansion and the [socket] shielding means having a different coefficient of thermal expansion; [and]

the shaft being disposed in the shielding means out of contact with the molten metal, and forming a chamber between the shaft and the shielding means sufficient to permit thermal expansion of the shaft without imposing a radial thermal stress on the shielding means; and

means connecting the shielding means to the shaft such that the shielding means and all internal components disposed therein rotate as a unit with the shaft.

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18. (Twice Amended) Apparatus for moving a stream of molten metal in a bath of the molten metal comprising:

a pumping member adapted to be disposed in a bath of a heated molten metal, and to move a stream of the molten metal as the pumping member is driven in a path of motion;

a power device adapted to be supported above the bath of molten metal, and to be actuated in a powered motion;

means for connecting the power device to the pumping member to move the pumping member in said path of motion, comprising;

a pumping shaft adapted to be connected to the power device to be rotated thereby;

a tubular shield means (50) of a heat resistant material telescopically receiving the shaft and having a length longer than the [shield means] shaft (24) so that the lower end of the shield means extends beyond the lower end of the shaft;

[means connecting the shaft to the shield means to rotate the shaft and the shield means together; and]

means connecting the shield means to the pumping member to rotate the shield means and the pumping member together; and

means connecting the shield means to the shaft such that the shield means and all internal components disposed therein rotate as a unit with the shaft.

In claim 25, line 3, change "pump housing" to --- pumping member ---, and in line 5, after "thereto" insert --- , ---.

26. (Twice Amended) Apparatus as defined in claim 18, including a pump housing at least partially enclosing the pumping member, and in which the shield means includes:

an outer tubular shield having a lower end attached to the [pump] pumping shaft;

an inner tubular shield telescopically disposed in said outer tubular shield and being cemented thereto;

the inner tubular shield having a bore with a diameter greater than the diameter of the pumping shaft, and enclosing the pumping shaft so as to form a chamber therearound;

the lower end of the inner tubular shield being spaced from the lower end of the outer tubular shield to form a shoulder;

a structure disposed adjacent the lower end of the drive shaft having a diameter greater than the diameter of the bore of the inner tubular shield but less than the diameter of the outer shield, and the structure engages

the shoulder to locate the lower end of the shaft with respect to the shield means; and

cement disposed in the lower end of the outer tubular shield with a socket accommodating the configuration of the lower end of the shaft but having a clearance therebetween to accommodate the relative thermal expansion characteristics of said [structure and the cement in the socket] shaft lower end but permitting the shaft lower end to be rotated with the socket to rotate the pumping member.

In claim 27, line 1, change "26" to --- 71 ---.

In claim 28, line 1, change "26" to --- 71 ---.

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~~46~~. (Amended) An apparatus for moving a stream of molten metal comprising:

a pumping member;

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a housing at least partially enclosing the pumping member;

a power device; [and]

a shaft connecting the power device and the pumping member to rotate same, said shaft having an elongated drive element; [and] an elongated shield assembly [, the shield assembly] surrounding[,] and forming a space between the drive element and the shield assembly sufficient to permit thermal expansion of the drive element; and

means connecting the shield assembly to the shaft such that the shield assembly and all internal components disposed therein rotate as a unit with the shaft.

In claim 53, line 1, change "52" to --- 72 ---.

55. (Amended) The apparatus as defined in claim 46, in which the shield assembly comprises:

an outer tubular shield having a lower end adjacent the housing,

an inner tubular shield telescopically disposed in said outer tubular shield and attached thereto;

the inner tubular shield having a bore with a diameter greater than the diameter of the drive element, and enclosing the drive element to form a chamber therearound;

a tongue extending from said drive element outside of said inner tubular shield;

[one or both of] said inner tubular shield [or] and said tongue being secured to said outer shield; and

said outer shield being secured to said pumping member.

In claim 56, line 1, change "55" to --- 72 ---.

In claim 64, line 1, change "63" to --- 74 ---.

Please add the following new claims:

69. Apparatus for moving a stream of molten metal in a bath of the molten metal comprising:

a pumping member adapted to be disposed in a bath of a heated molten metal, and to move a stream of the molten metal as the pumping member is driven in a path of motion;

a housing at least partially enclosing the pumping member;

a shielding means carried on the pump housing, the shielding means having an internal shaft-receiving opening;

a power device adapted to be supported above the bath of molten metal, and to be actuated in a powered motion;

means for connecting the power device to the pumping member to move the pumping member in said path of motion, comprising;

a rotatable pumping shaft having an upper end connected to the power device so as to be moved when the power device is actuated, and a lower driving end connected to the pumping member to drive the pumping member in said path of motion when the power device is actuated;

the shaft having a first coefficient of thermal expansion and the shielding means having a different coefficient of thermal expansion;

the shaft being telescopically disposed in the shielding means out of contact with the molten metal, and forming a chamber between the shaft and the shielding means sufficient to permit thermal expansion of the shaft without imposing a radial thermal stress on the shielding means;

the shielding means comprising an elongated tubular shield telescopically enclosing the pumping shaft, the tubular shield having a lower end attached to the pumping member, and an upper end, the tubular shield having a length such that the upper end is disposed above the metal surface of the bath of molten metal; the tubular shield including:

an outer tubular shield having a lower end attached to the pumping member;

an inner tubular shield telescopically disposed in said outer tubular shield and being attached thereto;

the inner tubular shield having a bore with a diameter greater than the diameter of the shaft, and enclosing the shaft so as to form said chamber therearound;

the lower end of the inner tubular shield being spaced from the lower end of the outer tubular shield to form a driving chamber;

a driving structure supported on the lower end of the shaft enclosed within the outer tubular shield; and

cement disposed in the outer tubular shield having a socket accommodating the configuration of said driving structure, the driving structure being disposed in said socket but having a clearance therebetween to accommodate the relative thermal expansion characteristics of said driving structure and the socket, but permitting the driving structure to be rotated to engage the socket in the cement to rotate the pumping member.

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70. Apparatus for moving a stream of molten metal in a bath of the molten metal comprising:

a pumping member adapted to be disposed in a bath of a heated molten metal, and to move a stream of the molten metal as the pumping member is driven in a path of motion;

a power device adapted to be supported above the bath of molten metal, and to be actuated in a powered motion;

means for connecting the power device to the pumping member to move the pumping member in said path of motion, comprising;

a shaft adapted to be connected to the power device to be rotated thereby;

a tubular shield means of a heat-resistant material telescopically receiving the shaft and having a length longer than the shaft so that the lower end of the shield means extends beyond the lower end of the shaft;

means connecting the shaft to the shield means to rotate the shaft and the shield means together;

means connecting the shield means to the pumping member to rotate the shield means and the pumping member together;

a pump housing at least partially enclosing the pumping member;

and in which the tubular shield means includes an outer tubular shield having a lower end attached to the pumping member; and

an inner tubular shield telescopically disposed in said outer tubular shield and being cemented thereto.

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11. Apparatus for moving a stream of molten metal in a bath of the molten metal, comprising:

a pumping member adapted to be disposed in a bath of a heated molten metal, and to move a stream of the molten metal as the pumping member is driven in a path of motion;

a power device adapted to be supported above the bath of molten metal, and to be actuated in a powered motion;

means for connecting the power device to the pumping member to move the pumping member in said path of motion, comprising;

a shaft adapted to be connected to the power device to be rotated thereby;

a tubular shield means of a heat-resistant material telescopically receiving the shaft and having a length longer than the shaft so that the lower end of the shield means extends beyond the lower end of the shaft;

means connecting the shaft to the shield means to rotate the shaft and the shield means together;

means connecting the shield means to the pumping member to rotate the shield means and the pumping member together;

a pump housing at last partially enclosing the pumping member, and in which the tubular shield means includes:

an outer tubular shield having a lower end attached to the shaft;

an inner tubular shield telescopically disposed in said outer tubular shield and being cemented thereto;

the inner tubular shield having a bore with a diameter greater than the diameter of the shaft, and enclosing the shaft so as to form a chamber therearound;

the lower end of the inner tubular member being spaced from the lower end of the outer tubular member to form a shoulder;

a structure disposed adjacent the lower end of the shaft having a diameter greater than the diameter of the bore of the inner tubular shield but less than the diameter of the outer shield, the structure engaging the shoulder to locate the lower end of the shaft with respect to the tubular shield means; and

cement disposed in the lower end of the outer tubular shield with a socket accommodating the configuration of the lower end of the shaft but having a clearance therebetween to accommodate the relative thermal expansion characteristics of said shaft lower end, but permitting the shaft lower end to be rotated in the socket to rotate the pumping member.

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72. An apparatus for moving a stream of molten metal, comprising:

a pumping member;

a housing at least partially enclosing the pumping member;

a power device;

a shaft connecting the power device and the pumping member, said shaft having an elongated drive element and an elongated shield assembly, the shield assembly surrounding, and forming a space between the drive element and the shield assembly sufficient to permit thermal expansion of the drive element;

the shield assembly further comprising inner and outer telescoping shield members; and

the drive element including a shoulder adjacent a pumping member end, and the inner shield member abuts said shoulder.

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~~73~~. An apparatus for moving a stream of molten metal comprising:

a pumping member;

a housing at least partially enclosing the pumping member;

a power device;

a shaft connecting the power device and the pumping member, said shaft having an elongated drive element and an elongated shield assembly, the shield assembly surrounding, and forming a space between the drive element and the shield assembly sufficient to permit thermal expansion of the drive element; and

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including at least one post supporting said power device above said housing;

said post including an annular groove;

said housing including a socket having a cooperative annular groove; and

a retaining element positioned in said grooves.

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74. An apparatus for moving a stream of molten metal comprising:

a pumping member;

a housing at least partially enclosing the pumping member;

a power device;

a shaft connecting the power device and the pumping member, said shaft having an elongated drive element and an elongated shield assembly, the shield assembly surrounding, and forming a space between the drive element and the shield assembly sufficient to permit thermal expansion of the drive element;

a post supporting said power device above said housing;

said post having a leg portion and a shield portion of heat-resistant material surrounding said leg portion; and

an inner diameter of said shield portion being greater than the outer diameter of said leg portion.

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75. Apparatus for moving a stream of molten metal in a bath of the molten metal comprising:

a pumping member adapted to be disposed in a bath of a heated molten metal, and to move a stream of the molten metal as the pumping member is driven in a path of motion;

a housing at least partially enclosing the pumping member;

a shielding means carried on the pump housing, the shielding means having an internal shaft-receiving opening;

a power device adapted to be supported above the bath of molten metal, and to be actuated in a powered motion;

means for connecting the power device to the pumping member to move the pumping member in said path of motion, comprising;

a pumping shaft having an upper end connected to the power device so as to be moved when the power device is actuated, and a lower driving end connected to the pumping member to drive the pumping member in said path of motion when the power device is actuated;

the shaft having a first coefficient of thermal expansion and the shielding means having a different coefficient of thermal expansion;

the shaft being telescopically disposed in the shielding means out of contact with the molten metal, and forming a chamber between the shaft and the shielding means sufficient to permit thermal expansion of the shaft without imposing a radial thermal stress on the shielding means;

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the shield means comprising an elongated tubular shield telescopically enclosing the pumping shaft, the tubular shield having a lower end attached to the pumping member, and an upper end, the tubular shield having a length such that the upper end is disposed above the metal surface of the bath of molten metal;

the tubular shield means including:

an outer tubular shield having a lower end attached to the pumping member;

an inner tubular shield telescopically disposed in said outer tubular shield and being attached thereto;

the inner tubular shield having a bore with a diameter greater than the diameter of the shaft, and enclosing the shaft so as to form a chamber therearound;

the lower end of the inner tubular shield being spaced from the lower end of the outer tubular shield to form a driving chamber;

a driving structure supported on the lower end of the shaft enclosed within the outer tubular shield; and

cement disposed in the outer shield having a socket accommodating the configuration of said driving structure, the driving structure being disposed in said socket but having a clearance therebetween to accommodate the relative thermal expansion characteristics of said driving structure and the socket, but permitting the driving structure to be rotated to engage the socket in the cement to rotate the pumping member;

the clearance between the driving structure and the socket being formed by the steps of:

forming the outer tubular shield with a lower blind end;

disposing cement in the blind end of the outer tubular shield to form a socket having the configuration similar to but larger than that of the driving structure;

disposing a wax that turns to a gas when exposed to the heat in the bath of molten metal, in said socket;

disposing the driving structure in the wax; and

telescopically inserting the inner tubular shield in the outer tubular shield to engage the driving structure, and cementing the inner tubular shield to the outer tubular shield to form a unitary tubular shield around the pumping shaft.

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~~76~~. Apparatus for moving a stream of molten metal in a bath of the molten metal comprising:

a pumping member adapted to be disposed in a bath of a heated molten metal, and to move a stream of the molten metal as the pumping member is driven in a path of motion;

a power device adapted to be supported above the bath of molten metal, and to be actuated in a powered motion;

means for connecting the power device to the pumping member to move the pumping member in said path of motion, comprising;

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a shaft adapted to be connected to the power device to be rotated thereby;

a tubular shield means of a heat-resistant material telescopically receiving the shaft and having a length longer than the shaft so that the lower end of the shield means extends beyond the lower end of the shaft;

means connecting the shaft to the shield means to rotate the shaft and the shield means together;

means connecting the shield means to the pumping member to rotate the shield means and the pumping member together;

a pump housing at least partially enclosing the pumping member, and in which the tubular shield means includes:

an outer tubular shield having a lower end connected to the shaft;

an inner tubular shield telescopically disposed in said outer tubular shield and being cemented thereto;

the inner tubular shield having a bore with a diameter greater than the diameter of the shaft, and enclosing the shaft so as to form a chamber therearound;

the lower end of the inner tubular shield being spaced from the lower end of the outer tubular shield to form a shoulder;

a structure disposed adjacent the lower end of the shaft having a diameter greater than the diameter of the bore of the inner tubular

shield but less than the diameter of the outer shield, the structure engaging the shoulder to locate the lower end of the shaft with respect to the tubular shield means;

cement disposed in the lower end of the outer tubular shield with a socket accommodating the configuration of the lower end of the shaft but having a clearance therebetween to accommodate the relative thermal expansion characteristics of said shaft lower end, but permitting the shaft to be rotated in the socket to rotate the pumping member;

the clearance between the lower end of the shaft and the socket being formed by the steps of:

forming the outer tubular shield with a lower blind end;

disposing a cement in the blind end of the outer tubular shield to form a socket having the configuration similar to but larger than that of said shaft lower end;

disposing a wax that turns to gas when exposed to the heat in the bath of molten metal in said socket;

disposing said structure in the wax;

inserting the inner tubular member into the outer tubular shield so as to engage said structure; and

cementing the inner tubular shield to the outer tubular shield to form a unitary tubular shield around the shaft.

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77. An apparatus for moving a stream of molten metal, comprising:

a pumping member;

a housing at least partially enclosing the pumping member;

a power device;

a shaft connecting the power device and the pumping member, said shaft having an elongated drive element and an elongated shield assembly, the shield assembly surrounding, and forming a space between the drive element and the shield assembly sufficient to permit thermal expansion of the drive element;

the shield assembly comprising:

an outer tubular shield having a lower end adjacent the housing;

an inner tubular shield telescopically disposed in said outer tubular shield and attached thereto;

the inner tubular shield having a bore with a diameter greater than the diameter of the drive element, and enclosing the drive element to form a chamber therearound;

a tongue extending from said drive element outside of said inner tubular shield;

said inner tubular shield and said tongue being secured to said outer shield, and

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said outer shield being secured to said pumping member.

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78. The apparatus as defined in claim 77, in which a clearance is provided between the tongue and the outer shield by the steps of:

forming the outer tubular shield with a lower blind end;

disposing a cement in the blind end of the outer tubular shield to form a socket having the configuration similar to but larger than that of the drive element;

disposing a wax that turns to gas when exposed to the heat in a bath of molten metal, in said socket;

positioning the drive element in the wax, and

telescopically inserting the inner tubular shield in the outer tubular shield to engage the drive element, and cementing the inner tubular shield to the outer tubular shield to form a unitary shield around the shaft.

REMARKS

Claims 1, 3-7, 9-16, 18-28, and 46-65 remain in the case for consideration.

Claim 18 was rejected under 35 U.S.C. 112 as being indefinite for failing to point out and distinctly claim the subject matter that Applicant regards as his invention.

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